

What Is Claimed Is:

1           Claim 1.       A solid-state scanning microscope, comprising:  
2           a source of collimated radiant energy for illuminating a sample, the sample  
3           having a first side and a second side, the radiant energy illuminating the first side of the  
4           sample;  
5           a plurality of narrow angle filters comprising a microchannel structure to permit  
6           the passage of only unscattered radiant energy through the microchannels, the  
7           microchannel structure having a first end and a second end, the first end of the  
8           microchannel structure placed near the second side of the sample on the side opposite  
9           the source of radiant energy, some portion of the radiant energy entering the  
10          microchannels from the sample;  
11          a solid-state sensing array comprising a plurality of sensing elements attached to  
12          the second end of the microchannel structure, the sensing elements being sensitive to  
13          radiant energy, a plurality of the microchannels being aligned each to correspond with  
14          an individual sensing element of the solid-state sensing array,  
15          wherein that portion of the radiant energy entering the microchannels  
16          that is parallel to the microchannel walls travels to the corresponding sensing elements  
17          generating electrical signals that can enable an image to be reconstructed by an external  
18          device; and  
19          a planar luminescent material layer for converting higher frequency radiant  
20          energy into a detectable range for the solid-state sensing elements, the luminescent  
21          material layer being inserted between the solid-state sensing array and the second end of  
22          the microchannel structure.

1           Claim 2.       A system as in one of Claim 1,  
2           wherein the radiant energy is X-Ray radiation.

1           Claim 3.       A solid-state scanning microscope, comprising:  
2           a source of collimated radiant energy;  
3           a plurality of narrow angle filters comprising a microchannel structure to permit  
4           the passage of only unscattered radiant energy through the microchannels, the

5 microchannel structure having a first end and a second end;  
6 a solid-state sensing array comprising a plurality of sensing elements, attached at  
7 the first end of the microchannel structure, the sensing elements being sensitive to  
8 radiant energy, a plurality of the microchannels being aligned each to correspond with  
9 an individual sensor element of the solid-state sensing array;  
10 a planar member of an optically conductive material suitable for conducting  
11 radiant energy, the planar member having a first side and a second side, the first side of  
12 the planar member being placed perpendicular to the second end of the microchannel  
13 structure and attached to the microchannel structure allowing for an air-gap between the  
14 planar member and the microchannel structure;  
15 an index matching fluid placed adjacent to the second side of the planar  
16 member, the index matching fluid being matched to the index of the planar member, the  
17 index matching fluid continuously filling the region between the surface of the sample  
18 and the second side of the planar member; and  
19 a prism placed upon the planar member so as to conduct the source of radiant  
20 energy operatively into the planar member, the radiant energy being reflected by the  
21 first side and not reflected by the second side of the planar member, the radiant energy  
22 escaping the second side of the planar member to illuminate the surface of the sample,  
23 some portion of the radiant energy being reflected by the sample to enter the  
24 microchannels, that portion of the radiant energy entering the microchannels that is  
25 parallel to the microchannel walls travels to the solid-state sensing elements to generate  
26 electrical signals that can enable an image to be reconstructed by an external device.

1 Claim 4. The solid-state scanning microscope of Claim 3,  
2 wherein the radiant energy is laser light radiation.

1 Claim 5. The solid-state scanning microscope of Claim 3,  
2 wherein the radiant energy is visible light radiation.

1 Claim 6. The solid-state scanning microscope of Claim 3,  
2 wherein the source of radiant energy is a solid-state emitter.

1           Claim 7.       A solid-state microscope, comprising:  
2           a plurality of narrow angle filters comprising a microchannel structure to permit  
3 the passage of only unscattered radiant energy through the microchannels, the  
4 microchannel structure having a first end and a second end;  
5           a solid-state sensing array comprising a plurality of sensing elements, attached at  
6 the first end of the microchannel structure, a plurality of the microchannels being  
7 aligned each to correspond with an individual sensing element of the sensing array;  
8           a plurality of solid-state emitters for emitting radiant energy mounted on the  
9 second end of the microchannel structure, the emitters illuminating the surface of a  
10 sample, some portion of the radiant energy being reflected by the sample to enter the  
11 microchannels, that portion of the radiant energy entering the microchannels that is  
12 parallel to the microchannel walls travels to the sensing elements to generate electrical  
13 signals that can enable an image to be reconstructed by an external device; and  
14           a transparent planar member adjacent to the second end of the microchannel  
15 structure, the transparent covering containing conduction paths to conduct power to the  
16 solid-state emitters, the transparent cover protecting the second end of the microchannel  
17 structure from damage and preventing the entrance of foreign objects into the  
18 microchannels.

1           Claim 8.       The solid-state scanning microscope of Claim 7,  
2           wherein the solid-state emitters are Light Emitting Diodes.

1           Claim 9.       The solid-state scanning microscope of Claim 7,  
2           wherein the solid-state emitters are Light Emitting Polymers.

1           Claim 10.     A solid-state microscope, comprising:  
2           a source of collimated radiant energy;  
3           a narrow angle filter comprising a microchannel to permit the passage of only  
4 unscattered radiant energy through the microchannel, the microchannel having a first  
5 end and a second end;  
6           a solid-state sensing element, attached at the first end of the microchannel, the  
7 microchannel being aligned with the sensing element; and

8           a polarizing beam splitting element having a partially reflective inner surface,  
9           the polarizing beam splitting element being inserted between the second end of the  
10          microchannel and a sample, the polarizing beam splitting element having a first side, a  
11          second side, and a third side, the first side being attached to the second end of the  
12          microchannel,  
13                 wherein the second side of the polarizing beam splitting element is  
14          perpendicular to the sample and receives the collimated radiant energy, the third side  
15          being adjacent to the sample and directing a portion of the internally reflected  
16          collimated radiant energy to the sample and receiving some portion of the radiant  
17          energy reflected by the sample, the third side being opposite the first side, the first side  
18          directing some portion of the sample reflected radiant energy to enter the microchannel,  
19          some portion of the radiant energy being reflected by the sample to enter the  
20          microchannel, that portion of the radiant energy entering the microchannel that is  
21          parallel to the microchannel walls travels to the sensing element to generate an  
22          electrical signal that can enable an image to be reconstructed by an external device.

1           Claim 11.     The solid-state scanning microscope of Claim 10,  
2                         wherein the radiant energy is laser light radiation.

1           Claim 12.     The solid-state scanning microscope of Claim 10,  
2                         wherein the radiant energy is visible light radiation.

1           Claim 13.     The solid-state scanning microscope of Claim 10,  
2                         wherein the source of radiant energy is a solid-state emitter.

1           Claim 14.     A solid-state microscope, comprising:  
2                         a source of collimated radiant energy, the source of collimated radiant energy  
3                         being X-Ray radiation;  
4                         a narrow angle filter comprising a microchannel to permit the passage of only  
5                         unscattered radiant energy through the microchannel, the microchannel having a first  
6                         end and a second end;  
7                         a solid-state sensing element, attached at the first end of the microchannel, the

8 microchannel being aligned with the sensing element;  
9 a planar luminescent material layer for converting higher frequency radiant  
10 energy into a detectable range for the solid-state sensing elements, the luminescent  
11 material layer being inserted between the solid-state sensing array and the first end of  
12 the microchannel structure;  
13 a beam splitting element having a partially reflective inner surface, the  
14 polarizing beam splitting element being inserted between the second end of the  
15 microchannel and a sample, the beam splitting element having a first side, a second  
16 side, and a third side, the first side being attached to the second end of the  
17 microchannel,  
18 wherein the second side of the beam splitting element is perpendicular to  
19 the sample and receives the collimated radiant energy, the third side being adjacent to  
20 the sample and directing a portion of the internally reflected collimated radiant energy  
21 to the sample and receiving some portion of the radiant energy reflected by the sample,  
22 the third side being opposite the first side, the first side directing some portion of the  
23 sample reflected radiant energy to enter the microchannel, some portion of the radiant  
24 energy being reflected by the sample to enter the microchannel, that portion of the  
25 radiant energy entering the microchannel that is parallel to the microchannel walls  
26 travels to the sensing element to generate an electrical signal that can enable an image  
27 to be reconstructed by an external device; and  
28 a waveguide for conducting the source of radiant energy to the second side of  
29 the beam splitter.

1 Claim 15. A solid-state microscope, comprising:  
2 a scanning stage for providing structural support for moving the microscope, the  
3 scanning stage having a first side and a second side;  
4 a solid-state emitter for radiating energy, the emitter having a first side and a  
5 second side, the first side of the emitter radiating energy, the second side of the emitter  
6 mounted to the first side of the scanning stage;  
7 a waveguide having a first end, a second end, and an internally reflective  
8 surface, the first end of the waveguide being attached to the second side of the solid

9 state emitter allowing radiant energy from the solid-state emitter to enter into the  
10 waveguide to be reflected by the internally reflective surface, the reflected radiant  
11 energy exiting at the second end of the waveguide;

12 a narrow angle filter comprising a microchannel to permit the passage of only  
13 unscattered radiant energy through the microchannel, the microchannel having a first  
14 end and a second end;

15 a beam splitting element adjacent to the second end of the waveguide and near a  
16 sample, the beam splitting element having a first side, a second side, and a third side,

17 wherein the first side of the beam splitting element is perpendicular to  
18 the sample and receives the reflected radiant energy from the waveguide and conducts  
19 the radiant energy to exit the second side of the beam splitting element, the second side  
20 of the beam splitting element being adjacent to a sample and directing a portion of the  
21 radiant energy to the sample and receiving some portion of the radiant energy reflected  
22 by the sample, the third side of the beam splitting element being opposite the second  
23 side of the beam splitting element and adjacent to the second end of the microchannels,  
24 the third side of the beam splitting element directing some portion of the reflected  
25 radiant energy to enter the microchannels, some portion of the radiant energy being  
26 reflected by the sample to enter the microchannel; and

27 a solid-state sensing element having a first side and a second side, the sensing  
28 element detecting radiant energy from the first side, the second side of the sensing  
29 element mounted to the first side of the scanning stage adjacent to the solid state  
30 emitter,

31 wherein that portion of the radiant energy entering the microchannel that  
32 is parallel to the microchannel walls travels to the sensing element to generate an  
33 electrical signal that can enable an image to be reconstructed by an external device.

1 Claim 16. The solid-state microscope of Claim 15,

2 wherein the beam splitting element has a polarizing filter.

1 Claim 17. A color solid-state scanning microscope, comprising:

2 a scanning stage for providing structural support for moving the  
3 microscope, the scanning stage having a first side and a second side;

4 a plurality of solid-state emitters for radiating energy, the wavelength of radiant  
5 energy of a predetermined number solid-state emitters is of at least two substantially  
6 different wavelengths, each emitter having a first side and a second side, the first side of  
7 each emitter radiates energy, the second side of each emitter is mounted to the first side  
8 of the scanning stage;

9 a plurality of waveguides, each waveguide having a first end, a second end, and  
10 an internally reflective surface, the first end of each waveguide being attached to the  
11 second side of a solid state emitter allowing radiant energy from the solid-state emitter  
12 to enter into the waveguide to be reflected by the internally reflective surface, the  
13 reflected radiant energy exiting at the second end of the waveguide;

14 a plurality of narrow angle filters comprising a microchannel structure to permit  
15 the passage of only unscattered radiant energy through the microchannel, the  
16 microchannel having a first end and a second end;

17 a plurality of beam splitting elements, each beam splitting element adjacent to  
18 the second end of the waveguide and near a sample, the beam splitting elements each  
19 having a first side, a second side, and a third side,

20 wherein the first side of each beam splitting element is perpendicular to  
21 the sample and receives the reflected radiant energy from the waveguide and conducts  
22 the radiant energy to exit the second side of the beam splitting element, the second side  
23 of the beam splitting element being adjacent to a sample and directing a portion of the  
24 radiant energy to the sample and receiving some portion of the radiant energy reflected  
25 by the sample, the third side of the beam splitting element being opposite the second  
26 side of the beam splitting element and adjacent to the second end of the microchannels,  
27 the third side of the beam splitting element directing some portion of the reflected  
28 radiant energy to enter the microchannels, some portion of the radiant energy being  
29 reflected by the sample to enter the microchannel; and

30 a plurality of solid-state sensing elements, each solid-state sensing element  
31 having a first side and a second side, the sensing element detecting radiant energy from  
32 the first side, the second side of the sensing element mounted to the first side of the  
33 scanning stage adjacent to the solid state emitter,

34 wherein that portion of the radiant energy entering the microchannel that

35 is parallel to the microchannel walls travels to the sensing element to generate an  
36 electrical signal that can enable an image to be reconstructed by an external device.

1 Claim 18. The color solid-state scanning microscope of Claim 17,  
2 wherein a predetermined number of beam splitting elements have a  
3 polarizing filter.

1 Claim 19. A method of scanning an array of sensing devices over a sample,  
2 comprising the steps of:  
3 applying an array of sensing devices to a sample, the array of sensing devices  
4 being composed of individual sensing elements arranged in a fixed pattern relative to  
5 each other;  
6 rotating the array of sensing devices a predetermined amount about an axis  
7 perpendicular to the plane containing the array of sensing devices; and  
8 traversing a linear scan path over the sample with the array of sensing devices,  
9 the individual sensing elements tracing parallel paths, the distance between the parallel  
10 paths being determined by the rotation of the array of sensing devices and the relative  
11 position of the individual sensing devices in the array, the parallel paths being non-  
12 overlapping, partially overlapping, or completely overlapping other parallel paths.

1 Claim 20. The method of Claim 19,  
2 wherein the array of sensing devices is a 1-dimensional, linear array.

1 Claim 21. The method of Claim 19,  
2 wherein the array of sensing devices is a 2-dimensional, planar array.